

DATATAPE®

12-443

MONITOR METER

TECHNICAL MANUAL



BELL & HOWELL

DATATAPE DIVISION

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SECTION I

GENERAL DESCRIPTION

1-1. GENERAL.

1-2. The 12-443 Monitor Meter is a dc peak reading meter which processes signals from the FM and direct record and reproduce amplifiers of the Bell & Howell portable magnetic tape system. Each of the amplifiers provides a normalized signal (adjusted after the normal record level, bias, center frequency, percentage of deviation, equalizers, and output level adjustments are correct) to the monitor meter. By selecting one of the amplifiers for monitoring, its status is easily determined by reading the meter scale which has -10, -6, 0, and +3 dB graduation marks. The normalized signal from the amplifiers causes the meter to read 0 dB which indicates that the input and output levels are properly adjusted.

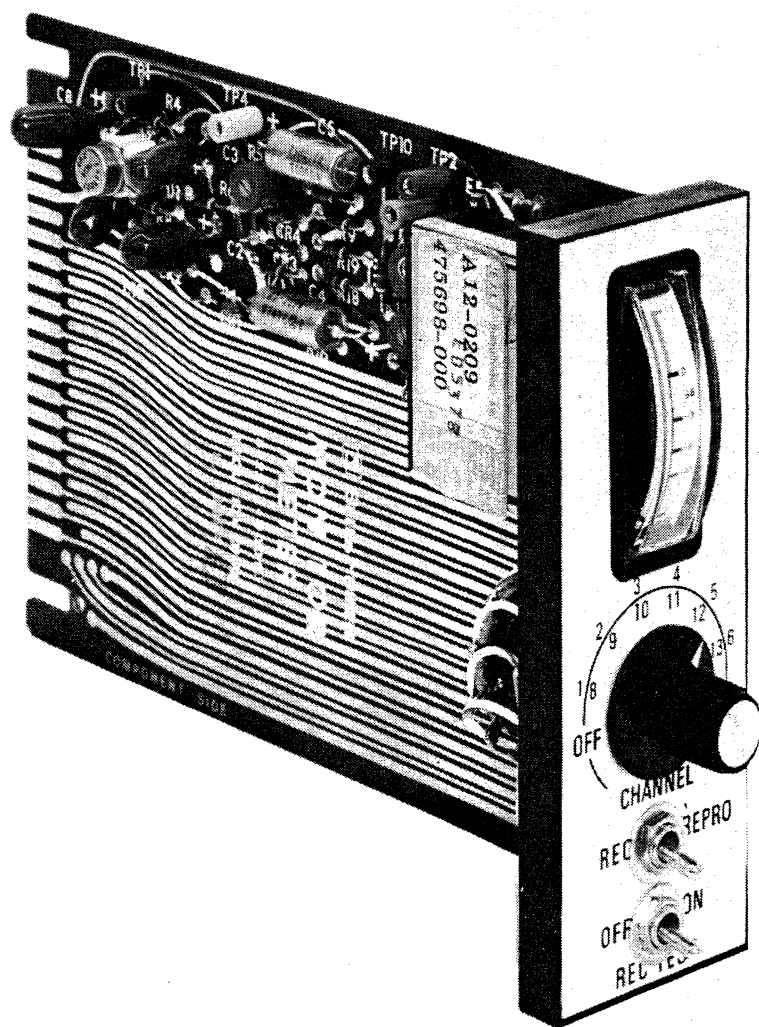
1-3. EQUIPMENT DESCRIPTION.

1-4. The monitor meter assembly consists of a printed circuit board and a front panel. The front panel contains the CHANNEL selector switches, the RECORD TEST switch, and an edge reading meter. The printed circuit board contains all the electronic components of the monitor meter circuit. Figure 1-1 illustrates the monitor meter assembly.

1-5. Typical performance characteristics of the monitor meter are given in table 1-1.

ITEM	CHARACTERISTIC
Input Signal Source	Record and reproduce amplifiers
Input Signal Levels (normalized for 0 dB)	100 mVrms from the record amplifiers 1 Vrms from the reproduce amplifiers
Input Attenuation	Times 1 for the record input Divide by 14 for the reproduce input
Meter Sensitivity	100 microamperes for full-scale deflection (+3 dB)
Operating Power Source	+15 and -15 Vdc from the voltage regulator circuit

Table 1-1. Typical Performance Data



KH3608-6

SECTION II

INSTALLATION

2-1. GENERAL.

2-2. When the 4020 system is installed on an initial installation, the 12-443 Monitor Meter Assembly is installed during the completion of the installation procedures as described in Section II of the system manual.

2-3. When replacing the monitor meter, follow the installation procedures in Section II of the system manual, and then operate the unit in accordance with the operation instructions contained in Section III of the system manual.

2-4. A label (Bell & Howell part number 476144), supplied with the 12-414A-5 Tape Width Kit, is to be installed behind the CHANNEL selector switch knob to convert channel numbers 1 through 7 to channel numbers 8 through 14. This corresponds to record/reproduce channels 8 through 14 for a 1-inch tape width system.

2-5. To install the label, proceed as follows:

- a. Remove the CHANNEL selector switch knob.
- b. Remove the hex nut securing the CHANNEL selector switch to the front panel.
- c. Peel the paper off the pressure sensitive adhesive on the back of the label.
- d. Grasp the label between thumb and index finger at 9 and 3 o'clock and install it over the CHANNEL selector shaft, being careful that the edges of the label line up with the edges of the label already in place, and press into place.
- e. Replace hex nut and knob removed in steps a and b.
- f. Verify correct indexing of knob.

SECTION III

OPERATION

3-1. GENERAL.

3-2. The 12-443 Monitor Meter Assembly is fully operational when power is turned on and the installation procedures outlined in Section II of the system manual have been completed. Refer to Section III of the system manual for the operational procedures of the 12-443 Monitor Meter Assembly.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

4-2. The monitor meter circuit consists of two switches, three differential operational amplifiers, a full-wave rectifier, and a meter. The monitor meter also contains a RCD TEST (record test) switch. Figure 7-1 is a schematic of the monitor meter circuit and may be used along with the block diagram of the monitor meter shown in figure 4-1.

4-3. CHANNEL SELECTOR SWITCHES AND INPUT ATTENUATION.

4-4. The signals from the record and reproduce amplifiers are received at the circuit card pins F through W. The channel to be monitored is selected by the front panel two-pole switch S2 (record and reproduce channels are selected simultaneously). The rotary contacts of the switch are connected to the front panel double-throw toggle (REC/REPRO) switch. The reproduce leg is connected through an attenuator network (R2, R3) to reduce the reproduce input to 1/10 level.

4-5. DIFFERENTIAL INPUT AMPLIFIER.

4-6. The selected input signal (record or reproduce) is conducted to the differential amplifier (U1) positive input (negative input is a degenerative input to provide stability). Potentiometer R5 adjusts the dc offset and is used to produce a dc zero when no signal is present.

4-7. FULL-WAVE RECTIFIER.

4-8. Diodes CR3 and CR4 rectify positive and negative signal excursions, respectively. The positive excursions, rectified by diode CR3, are filtered by resistor R16 and capacitor C4, and drive amplifier U3. Negative excursions, rectified by diode CR4, are filtered (R9, C5), and drive amplifier U2. These rectifier circuits produce an output proportional to the peak voltage input (regardless of wave shape) and indirectly drive a meter calibrated in relative ac levels (i.e., decibels). Therefore, metering is most accurate when the calibrating signal is a sine wave. Note that these circuits also accurately measure dc without respect for polarity.

4-9. METER DRIVER.

4-10. The meter driver is comprised of differential amplifiers U2 and U3, which amplify the negative and positive filtered dc levels, respectively. The output of amplifier U3 drives the positive meter input; the output of amplifier U2 drives the negative meter input. Thus, either input (positive or negative) drives the meter in the same direction (the meter measures the potential difference between the positive and negative outputs of the amplifiers). Amplifier U2 dc offset is adjustable (potentiometer R15) and is used to adjust the meter zero setting when no signal is present. (Note that this dc offset serves the same function as the dc offset adjust, R5, described earlier, and both are interacting.)

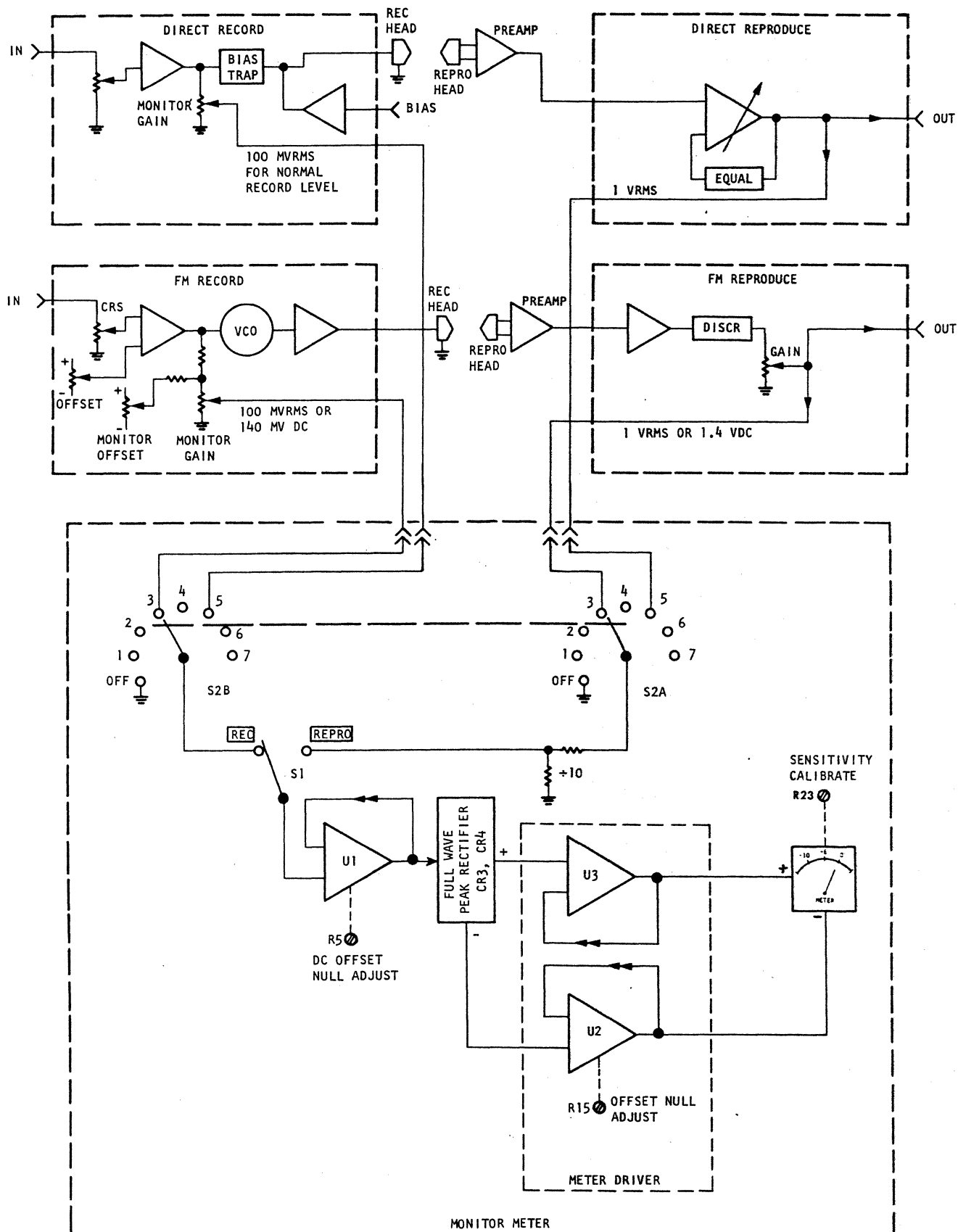


Figure 4-1. Monitor Meter Block Diagram and Input Signal Source

4-11. METER.

4-12. The meter (M1) has an edge-reading dial and reads full scale at 100 μ amperes. The meter sensitivity is adjusted with the series potentiometer R23, which calibrates the meter for 0 dB (1 Vrms or 1.4 Vdc on reproduce and 100 mVrms or 140 mVdc on record). Note that the record monitor levels are individually adjustable for each channel on the record amplifier circuit cards to produce a meter reading of 0 dB for a normal record level without regard for record sensitivity.

4-13. RECORD TEST SWITCH.

4-14. The RCD TEST switch is used to energize the record amplifiers for test purposes without operating the transport. In the ON position, this switch activates the record enable command line and inhibits the transport operating modes. These functions of the RCD TEST switch are generated in the control logic circuit.

SECTION V
CALIBRATION AND MAINTENANCE

5-1. GENERAL.

5-2. Maintenance for the 12-443 Monitor Meter Assembly consists of preventive maintenance, calibration, and troubleshooting and corrective maintenance.

5-3. PREVENTIVE MAINTENANCE.

5-4. Preventive maintenance consists of general cleaning and periodic inspection. Accumulation of dust, dirt, grit, and/or grease on the circuit board is harmful and should be guarded against by periodic inspection and cleaning. Every three months, inspect the circuit board for signs of deterioration, loose connections, insecurity of mounting, and foreign matter. The period of cleaning depends on the particular operating environment and should be determined by inspection. As necessary, clean the circuit board with a soft brush, low air pressure, or suitable solvent, being careful not to damage the printed circuitry.

5-5. CALIBRATION PROCEDURES.

5-6. To calibrate the monitor meter, follow the procedures given below (refer to figure 5-1):

- a. Turn OFF transport power.
- b. Mount monitor meter on extender card.
- c. Turn transport power ON.
- d. Set CHANNEL selector switch to OFF position.
- e. Adjust zero offset potentiometers R5 and R15 for zero pointer deflection.

NOTE

If potentiometer R5 is at limit (against stop) without a zero null, change potentiometer R15 position and readjust R5.

f. Simultaneously record and reproduce a 1 kHz signal on channel 1, adjust the reproduce amplifier output for 1 Vrms. With the CHANNEL selector switches, select reproduce channel 1 and adjust the 0 dB potentiometer R23 until the pointer reads 0 dB.

NOTE

An alternate method of step f (above) is to remove the reproduce amplifier of channel 1 and to introduce a 1 kHz, 1 Vrms signal between pins D and F on the extender card, then adjust R23 until the pointer reads 0 dB.

5-7. The previous procedures adjust the meter to read 0 dB for any 1 Vrms direct reproduce signal, any 100 mVrms direct or FM record signal, or any 1 Vrms or 1.414 Vdc FM reproduce signal.

5-8. TROUBLESHOOTING AND CORRECTIVE MAINTENANCE.

5-9. Before attempting the repair of suspected malfunctions, verify that the symptom is not caused by the malfunction of associated equipment such as the reproduce preamplifier, the power supply, the connector board assembly, or other errors.

5-10. Once the existence of a defective stage has been established, check the circuit board for obvious signs of damaged components, such as burned resistors, or incorrect seating of components. The next step is to check that the proper supply voltage is reaching the unit. If the supply voltage is correct, the faulty stage can be located by tracing the signals from stage to stage.

5-11. Once the defective stage has been located, the defective components in that stage can be determined by reference to the schematic diagram and by making continuity checks, voltage checks, and/or resistance measurements about the suspected components. The prime exception to this is open coupling capacitors, which should be checked by substitution, or by adding a test capacitor in parallel.

5-12. REPAIR.

5-13. Repair of the monitor meter should be attempted only by an electronics technician or by personnel experienced in printed wiring techniques. Recommended repair is limited to the replacement of defective components and adjustment of controls. When removing and replacing defective components, care should be exercised so as not to damage surrounding components or the circuit board. Replacement parts must be of the correct type and value, as listed in the parts list in Section VI. When installing a new part, place it in the exact position of the replaced part. After replacement, carefully inspect the circuit board for evidence of cold solder joints, solder splashes, and insecurity of mounting. If the equipment is repaired, the unit should be checked as described in paragraph 5-5 of this section.

5-14. PARTS IDENTIFICATION.

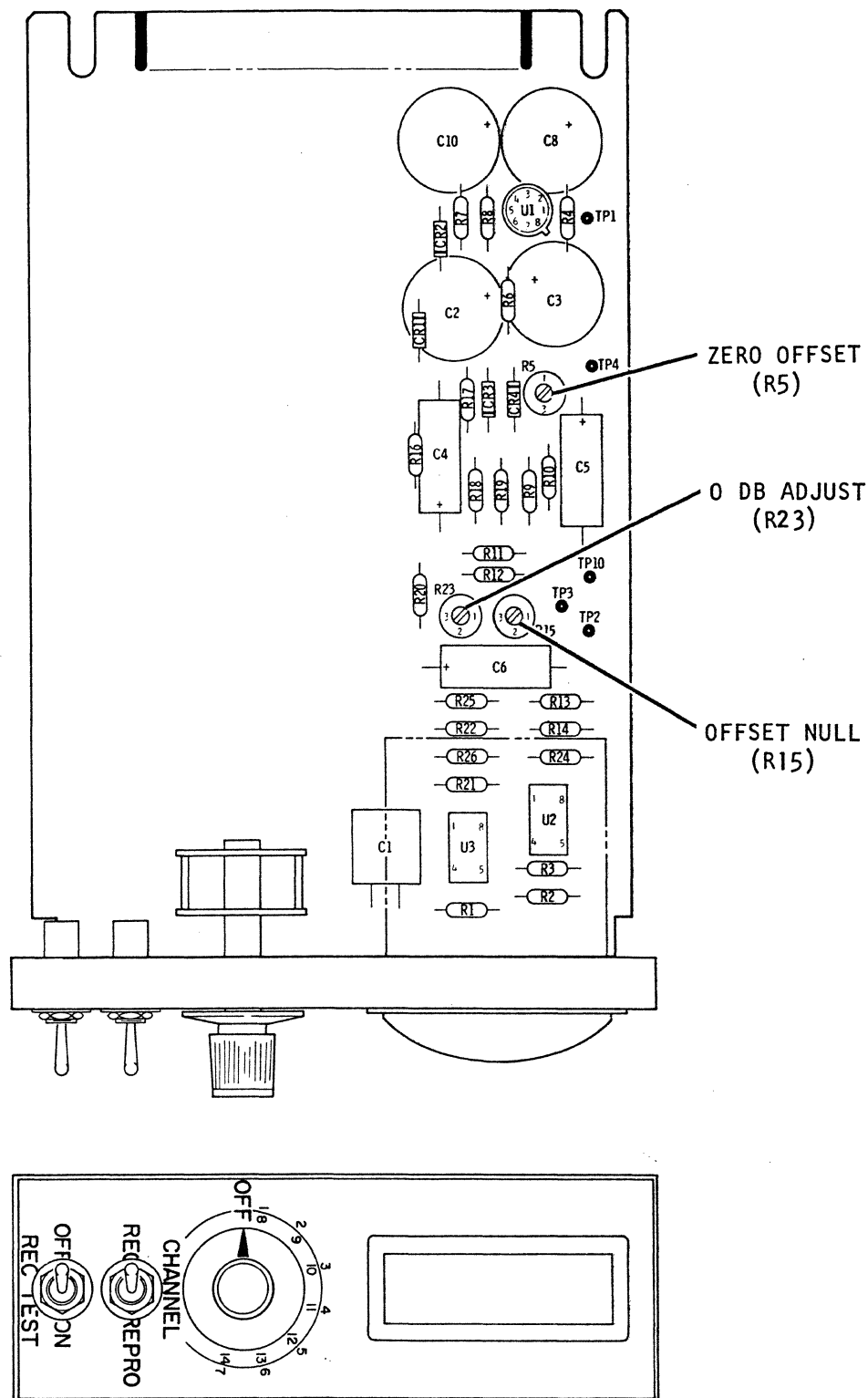
5-15. Components of the 12-443 Monitor Meter Assembly are illustrated and listed in Section VI. The parts list itemizes the component parts of the monitor meter and provides the Bell & Howell part number for each component of the monitor meter assembly.

5-16. FIELD REPAIR SERVICE.

5-17. Refer to Section V of the system manual for field repair service information.

5-18. FACTORY REPAIR SERVICE.

5-19. Refer to Section V of the system manual for factory repair service information.



D-522324-C (REF)

Figure 5-1. Monitor Meter Circuit Board
and Front Panel

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SECTION VI

PARTS LIST

6-1. GENERAL.

6-2. Appropriate parts lists and illustrations for the 12-443 Monitor Meter, Bell & Howell part number 522344, covered by this manual follow the instructions given below. The parts list (table 6-1) includes Bell & Howell DATATAPE Division part number, description, figure and index and/or schematic reference symbol, and where applicable, the manufacturer's or military part number for each component.

6-3. MANUFACTURER'S CODES.

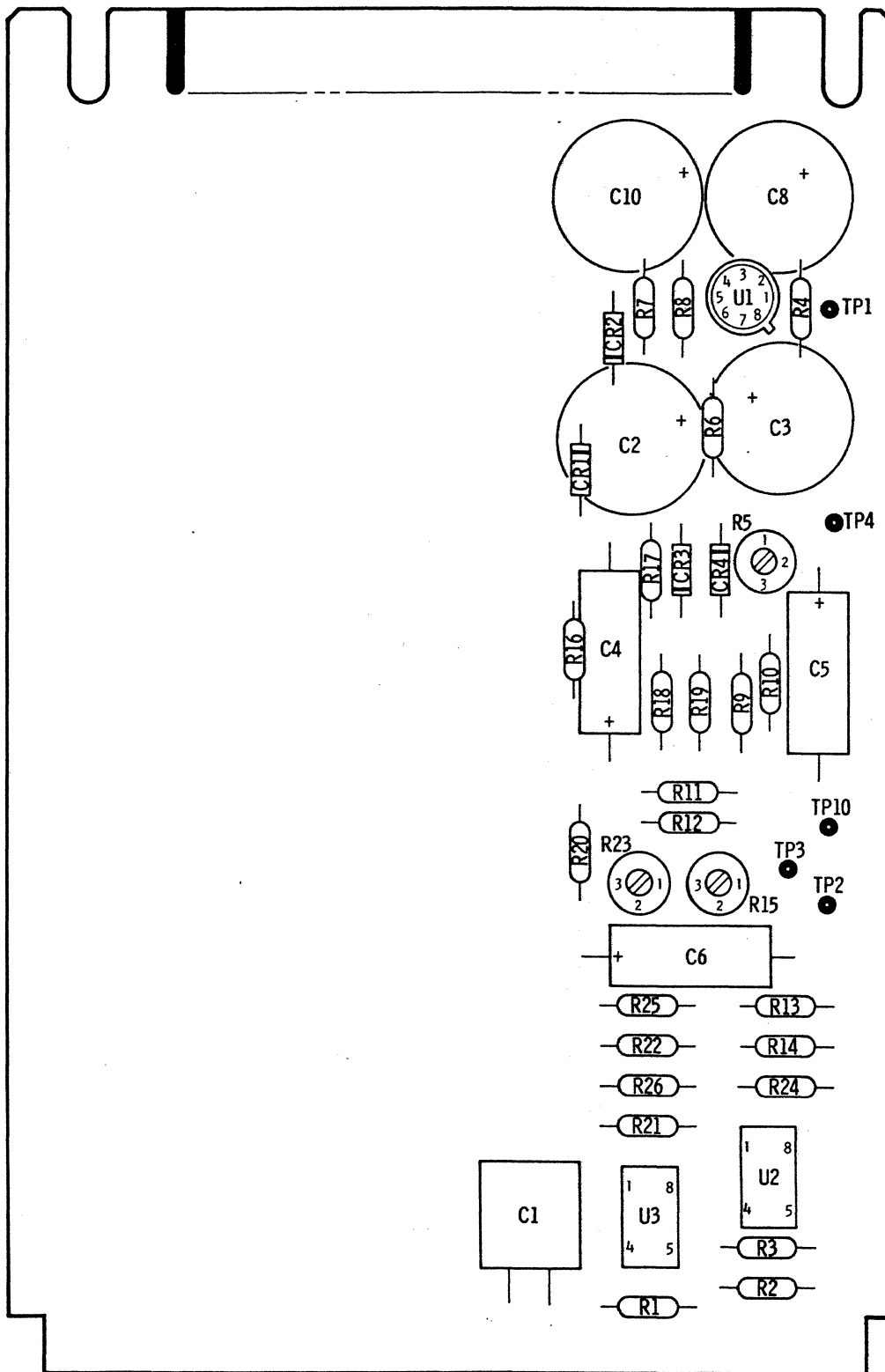
6-4. Manufacturer's code symbols used in the parts list are tabulated in the System manual with the manufacturer's name and address. All code symbols are in accordance with the Federal Supply Code for Manufacturers Handbooks H 4-1 and H 4-2.

6-5. ORDERING REPLACEMENT PARTS.

6-6. When ordering replacement parts refer to Section VI of the System manual for ordering instructions.

6-7. PARTS LOCATION ILLUSTRATIONS.

6-8. Figure 6-1 illustrates the location of components on the circuit card.



D-522324-C (REF)

Table 6-1. Parts List for the 12-443 Monitor Meter Assembly (Sheet 1 of 3)

ITEM NO.	B&H PART NO.	DESCRIPTION 0 1 2 3 4 5 6	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
1	522344	Monitor Meter Assembly	1		14028	
2	522324-0001	Board, printed circuit	1	6-1	14028	
3	246954	Diode, signal switching 25 V working voltage	4	CR1,2,3, CR4	03508	1N4154
4	70094-0031	Cap, fixed, mica 150 pF $\pm 5\%$, 500 Vdc	1	C1	93790	CD15F151J03-500WV
5	471920-0007	Cap, fixed, tantalum 68 uF $\pm 20\%$, 25 Vdc	4	C2,3,8, C10	05397	T362-D-686-M- C25-AS
6	70143-0386	Cap, fixed, tantalum 39 uF $\pm 20\%$, 20 Vdc	3	C4,5,6	31433	CS13
7	471922-1022	Res, fixed, metal oxide 1000 ohm $\pm 2\%$, 1/4 W	4	R1,6, R25,26	24546	C4-1K OHM 2 PCT
8	471922-5632	Res, fixed, metal oxide 56K ohm $\pm 2\%$, 1/4 W	6	R10,12, R14,17, R19,21	24546	C4-56K OHM 2 PCT
9	471922-1042	Res, fixed, metal oxide 100K ohm $\pm 2\%$, 1/4 W	4	R11,13, R18,20	24546	C4-100K OHM 2 PCT
10	471922-9122	Res, fixed, metal oxide 9.1K ohm $\pm 2\%$, 1/4 W	1	R2	24546	C4-9100 OHM 2 PCT
11	471922-2032	Res, fixed, metal oxide 20K ohm $\pm 2\%$, 1/4 W	1	R22	24546	C4-20K OHM 2 PCT
12	366427-0011	Res, var, cermet 20K ohm $\pm 20\%$, 1/2 W	1	R23	32997	3339P-1-203
13	471922-2012	Res, fixed, metal oxide 200 ohm $\pm 2\%$, 1/4 W	1	R24	24546	C4-200 OHM 2 PCT
14	471922-1122	Res, fixed, metal oxide 1.1K ohm $\pm 2\%$, 1/4 W	1	R3	24546	C4-1.1K OHM 2 PCT
15	471922-1032	Res, fixed, metal oxide 10K ohm $\pm 2\%$, 1/4 W	1	R4	24546	C4-10K OHM 2 PCT

Table 6-1. Parts List for the 12-443 Monitor Meter Assembly (Sheet 2 of 3)

ITEM NO.	B&H PART NO.	DESCRIPTION 0 1 2 3 4 5 6	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
1	366427-0010	Res, var, cermet 10K ohm $\pm 20\%$, 1/2 W	2	6-1 R5,15	32997	3339P-1-103
2	471922-3932	Res, fixed, metal oxide 39K ohm $\pm 2\%$, 1/4 W	1	R7	24546	C4-39K OHM 2 PCT
3	471922-4332	Res, fixed, metal oxide 43K ohm $\pm 2\%$, 1/4 W	1	R8	24546	C4-43K OHM 2 PCT
4	471922-5612	Res, fixed, metal oxide 560 ohm $\pm 2\%$, 1/4 W	2	R9,16	24546	C4-560 OHM 2 PCT
5	376087-0001	Connector, (vertical jack) brown	1	TP1	74970	105-858
6	376087-0010	Connector, (vertical jack) black	1	TP10	74970	105-853
7	376087-0002	Connector, (vertical jack) red	1	TP2	74970	105-852
8	376087-0003	Connector, (vertical jack) orange	1	TP3	74970	105-856
9	376087-0004	Connector, (vertical jack) yellow	1	TP4	74970	105-857
10	520009	Integrated Circuit CA3100T	1	U1	02735	CA3100T
11	471957	Integrated Circuit 741C operational amplifier	2	U2,3	07263	UA741TC
12	522324	Board, printed circuit	1		14028	
13	363102-0002	Socket, transistor no. of contacts 8	1		91506	8058-39G3
14	522346	Panel Assembly, front	1		14028	
15	475698	Meter, edge, reading 100 uA fs bo -10 dB to +0 dB	1	M1	81030	1122

Table 6-1. Parts List for the 12-443 Monitor Meter Assembly (Sheet 3 of 3)

ITEM NO.	B&H PART NO.	DESCRIPTION 0 1 2 3 4 5 6	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
1	247234-0001	Switch, toggle 1P2T on-none-on	2	6-1 S1,3	09353	7101
2	475227-0001	Switch, rotary	1	S2	76854	275427-A2- SPECIAL
3	379381	Panel, front	1			
4	475226-0001	Knob, indicator, skirted	1			

SECTION VII

SCHEMATICS

7-1. GENERAL.

7-2. This section contains the schematic diagram (figure 7-1) for the 12-443 Monitor Meter.

4. E39 AND E40 NOT USED ON THIS ASSEMBLY.
3. SYMBOL SHOWN THUS  SIMULATES COAXIAL SHIELD BY GROUND PLANE CONDUCTORS ON BOTH SIDES OF PRINTED WIRING BOARD.
2. ALL CAPACITORS ARE IN μ F/VOLTS.
1. ALL RESISTORS ARE IN OHMS $\pm 2\%$, 1/4 W.

NOTES: UNLESS OTHERWISE SPECIFIED.

LAST COMPONENT DESIGNATION USED
C10,CR4,R26,TP10,U3

COMPONENT DESIGNATION OMITTED
C7,C9,E2,E9 THRU E20,TP5 THRU TP9

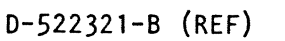


Figure 7-1. Schematic, 12-443 Monitor Meter